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ABSTRACT

The curriculum described in this manual covers basic drafting skills and entry skills for architectural, civil, and machine drafting, for both secondary and postsecondary instruction. The manual describes how the program is organized and gives objectives and exit points for the total curriculum. All of the tasks and units are listed with their relationships to one another. In addition to a curriculum description, the manual provides guidelines and hints for setting up and operating an individualized program. Setting up learning facilities, starting, and managing learning are viewed from an individualized instruction perspective. These sections, along with the selected references given, can be used as guides to setting up an instructional system using individualized methods. The important aspects of record keeping and grading are discussed and suggestions outlined for carrying out these tasks. The purpose of the curriculum is to train students to be able to enter business and industry at the job entry level of the following drafting occupations: assistant drafter, drafting detailer, architectural drafter, civil drafter, and machine drafter. The curriculum is designed so that accepted practices and procedures are incorporated as an integral part of the learning. (KC)

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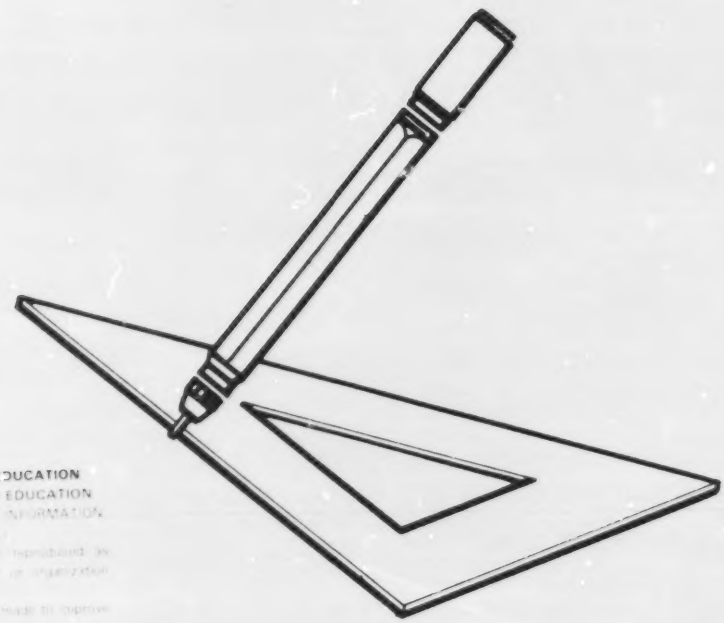

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INSTRUCTOR GUIDE
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Charles McDaniel, State Superintendent of Schools
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INTRODUCTION

The drafting program described in this manual has been designed to be used in both secondary and post-secondary schools. It is an articulated curriculum which allows students to move from secondary to post-secondary school without loss of continuity or credit.

The curriculum in the program covers basic drafting skills and entry skills for architectural, civil and machine drafting.

This volume of the teachers materials describes the make up of the curriculum and the instructional system around which it was designed.

1. HOW TO USE THIS DOCUMENT

This volume of the teachers material can be used to plan and implement an individualized program in drafting. The manual describes how the program is organized and gives objectives and exit points for the total curriculum. All of the tasks and units are listed with their relationships to one another. Using this information, an instructor will be able to develop the needed information to describe a program and courses for that program. The task listing, units and exit points will allow him/her to describe the content and sequence of learning for courses and a program.

In addition to a curriculum description, this manual provides guidelines and hints for setting up and operating an individualized program. Setting up learning facilities starting and managing are viewed from an individualized instruction perspective. These sections, along with the selected references given, can be used as guides to setting up an instructional system using individualized methods. The important aspects of record keeping and grading are discussed and suggestions outlined for taking care of both of these.

2. PURPOSE

The purpose of the drafting curriculum is to train students to be able to enter business and industry at the job entry level of the following drafting occupations.

Assistant Drafter
Drafting Detailer
Architectural Drafter
Civil Drafter
Machine Drafter

The curriculum is designed so that accepted practices and procedures are incorporated as an integral part of the learning. The curriculum materials provide learning for the tasks needed to master basic drawing skills and also allow for each instructor to supplement units with problems which will help students prepare for the jobs available locally.

3. OBJECTIVES

Program Objectives

1. To provide the skills necessary for successful employment in the fields of drafting included in the curriculum.

2. To insure adequate knowledge of procedures used in drafting occupations.

3. To instill the qualities of good workmanship and dependability needed by successful employees.

4. To provide each student with learning skills that will permit them to continue their education on-the-job and formally as it is needed.

5. To provide success in learning for all individuals who are capable and can profit from vocational training in drafting.

Major Block: The drafting program is divided into basic and advanced courses. The basic course contains six (6) blocks and is designed for two student exit points, drafting assistant and detailer. A model on page 17 shows how the exit points differ in terms of major blocks. The advanced course includes application for mechanical, architectural, and civil drafting.

Block 10: This major block, preparing finished drawings, contains skills which enable drafters to use drafting instruments and tools to trace, ink and letter drawings for presentation. The use of instruments and media to create charts, graphs and other presentations are also contained. Finally, the skills necessary to reproduce, file, store, and retrieve drawings are included.

Block 20: This block, basic multiview drawing, contains skills necessary to construct drawings from a single view to a three-view drawing. Dimensioning skills appropriate for these types of drawings are also included.

Block 30: This block, sectional views, contains skills needed to prepare and dimension the following types of sectional views: full section; half section; broken out section; revolved section; removed section; offset section; aligned section.

Block 40: This block, basic pictorial drawings, contains basic techniques required to prepare isometric drawings and to prepare pictorial freehand sketches. An introduction to the preparation of technical illustration is also included.

Block 50: This block, assembly drawing, includes skills needed to prepare assembly and sub-assembly drawings. Basic drawings of exploded illustration of assembly drawings is also included.

Block 200: This block, multiview drawings with auxiliary views, contains the skills necessary to prepare and dimension multiview drawings with auxiliary views.

Block A: This block, architectural drawing, contains the skills necessary to prepare residential plans.

Block M: This block, machine drawing, contains the skills necessary to prepare drawings of basic machine parts and assemblies.

Block C: This block, civil drawing, presents the skills needed to plot traverses, draw plats, profiles and maps from the surveyor's field notes.

4. EXIT POINTS

The tasks in this program are arranged to allow a student to exit at the following points. Although other occupations may be contained in this program, only those recognized by D.O.T. code are listed.

	Occupation	D.O.T. Code
Basic		
1.	Drafter, Assistant	017.281-018
2.	Detailer	017.261-018
Advanced		
3.	Architectural	001.261-010
4.	Mechanical	007.281-010
5.	Civil	005.281-010

5. CURRICULUM STRUCTURE OVERVIEWS

Why Individualized Curriculum Was Developed: The curriculum described in this manual is different from a traditional design in many ways. To understand these differences it may be helpful to know the objectives toward which the design was aimed. Originally, several problems in Georgia's Vocational Schools led to an attempt to meet the following objectives.

1. Design a curriculum delivery system which will allow students to enter a program where they have needs and leave whenever these needs have been met.

2. Increase the utilization of the facilities and equipment of a school by increasing the number of student hours each year.

3. Allow students to learn as fast as they are capable of learning.

4. Have enough flexibility to successfully handle individual needs and goals.

The curriculum content of this program is based on a traditional analysis of the occupation of drafting. The delivery system employed is not traditional; nor is there a claim made that the curriculum is individualized in the modern sense. The delivery system and curriculum design can best be described as a planned instructional system for individual learning. The materials are multi-media with the instructor functioning as a manager of learning and an important instructional aid. He is not only "programmed" into the learning activities, but is also always available when the planned activities are not adequate for an individual's abilities.

Key Advantages of Curriculum Design: Whenever and wherever possible materials are used which are similar to those which the student will use on the job. A dual purpose is served by this policy. First, the student receives the needed instructions and second each learns how to use the materials.

The school's facilities and equipment receive greater utilization from the fact that the enrollment per hour tends to increase and the hours of use per day also increases. No longer is there a need for a minimum number of students locked together at the same point in the program. The minimum number still is required, but their position in the instructional sequence is determined only by their progress. There is no need for even two students to be learning the same skills at any one time.

By this same fact there is no need for any student to wait on another to progress before moving on, nor is there any reason for a student to move on before having accomplished the specific instructional objective. Time becomes an individual characteristic. Each person uses as little time as needed to learn.

Because of the non-dependence of one student on another, the instructor can tailor a program to fit an individual's personal needs and as the system develops and expands, the system will react to more individual learning needs.

A. GENERAL PROGRAM CHARACTERISTICS

Planned Instruction: When students begin a program, all the tasks which they will try to complete are planned so that there is no question about what they have to do to reach the final objective. All of the necessary materials they need for work are stored for easy access. They know what to use, when to use it, and where to find it. Although it is possible to change or add to the basic program, it is not necessary except when a student has a special goal.

Job Oriented: The ultimate goal of this program is to make sure the student training in the program will be able to successfully enter and work in a drafting trade. To help make sure this happens, several guidelines have been written.

1. The tasks each person learns are as close as possible to the ones done on the job. The objective for each task is based on what will be expected on the job and the standards set for shop work are in terms of occupational standards.

2. When it is possible, manuals and other training materials which will be used on the job are also used as learning resources. A hidden but important reason for doing this is to train the student in correct and effective use of these materials.

3. Throughout this program, there has been an attempt made to instill the habits and attitudes into individuals so that they may be successful in their jobs. These include safety, workmanship, punctuality and self-discipline.

Motivational: This program is designed to be self-motivating as compared to a group-lecture method. Motivation is helped by two important characteristics of the program. First, the tasks students work on are related to what they want to do in the future. Second, each student can learn as fast as possible. No one is held back by being forced to go at the pace of the slowest student in a group.

In addition to this, the learning is organized so that the related knowledge is learned as close in time to its application as possible. Whenever it could be done, Math, Science, and English skills needed for a task are treated in this way. Section "C" of this manual goes into more detail about how this differs from the traditional programs.

Ease of Entry and Re-entry Into a Program: This program is set up in individual instructional units so that persons may easily enter and exit from the program as it is necessary. They can do this without losing credit for past work. This will, of course, always depend on the program's openings and the instructor's judgement.

B. SPECIFIC PROGRAM CHARACTERISTICS

Curriculum Design: The drafting program is designed so that there are many points where an individual can enter and leave the program successfully. This design provides for the different combinations of skills and levels of proficiency needed by drafters in various occupations.

If they had no prior knowledge, the starting point would be the same as the typical student, but the path through the program would follow only those tasks needed for their specific occupational goal. If they had prior experience and could demonstrate proficiency in basic skills, they would be able to enter at an advanced level and complete only those tasks in which they were not already proficient.

Because of the unit or module structure of the curriculum and the attempt to eliminate unnecessary prerequisites, the curriculum design used allows individuals with prior training and experience to satisfy needs which relate only to advanced study or updating of skills.

C. T & I CURRICULUM STRUCTURE (OLD & NEW)

The typical T & I curriculum has traditionally been broken into 56* hour blocks or multiples thereof. These blocks are arranged into quarters by combining six of the 56 hour increments to make a six hour school day.

56	THEORY	(Knowledge 101)
56	THEORY	(Knowledge 201)
112	LABORATORY	(Lab 101)
56	RELATED	(Gen. Related 101)
56	RELATED	(Job Related 101)

Figure 1 Typical Yearly Quarter

A student who enters begins with the most basic theory course and, after acquiring the theory and related courses, begins laboratory courses which teach the manipulative skills and occupational application of what has been learned.

In a typical program, the amount of theory and related material will decrease during the year and the hours for practice and application will increase.

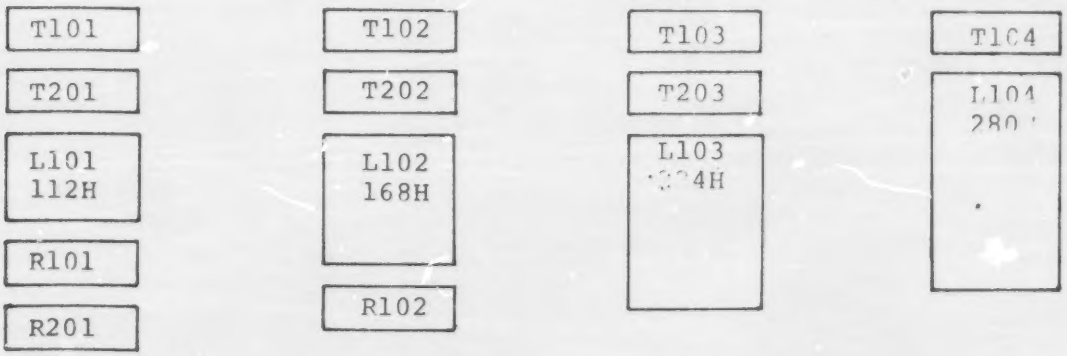


Figure 2 Typical Yearly Curriculum

The procedure for arriving at the content for each of these blocks has been to perform an occupational analysis. The output of the analysis, in terms of the skills and knowledges needed for each task, are grouped into common areas or courses.

*56 hours represents a one (1) hour course taught for one quarter 56 days in length.

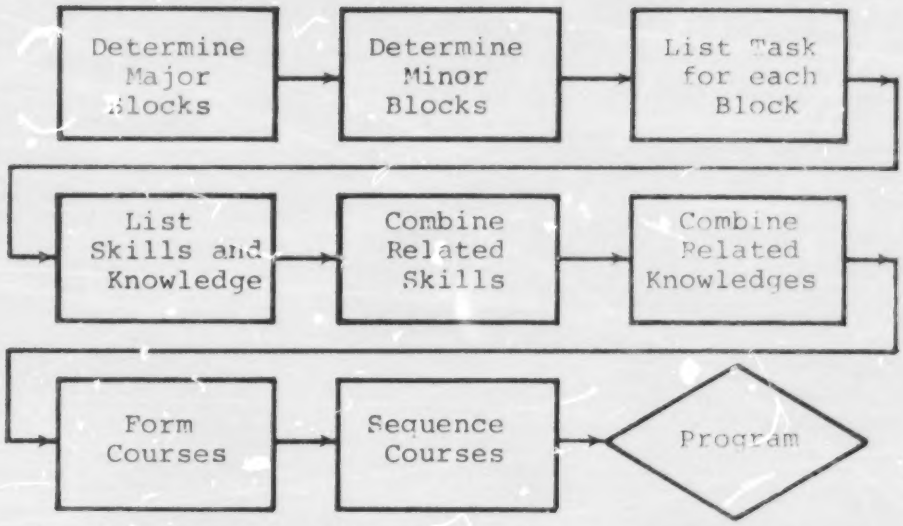


Figure 3. Basic Steps in Program Design

Looking at this process critically, you can see some situations which occur that are not the most desirable from a learning and motivational standpoint.

The determination of major and minor blocks and listing of the tasks in an occupation are essential first steps in any analysis. Although major and minor blocks are not always a necessity, the listing of the tasks performed in an occupation is the only realistic basis for developing training for that occupation. The skills and knowledges needed for each task are also essential information in planning the training program for an occupation. The major problem comes when these skills and knowledges are combined to form courses and the courses must be sequenced because of the requirements of hours and quarters. Looking at the typical yearly curriculum illustrated previously (Figure 2), notice the high concentration of theory and related courses in the first quarter. This is generally true because the beginning tasks require some knowledge of several different theory or related areas (i.e. T101, R101, R201). This means a student must study a great amount of theory which may not be applied for several months.

The situation is not motivating because in many cases no reason for learning the particular information is evident and the learning of theory only is too reminiscent of past educational experiences which were not always successful or satisfying. Since the application of the theory (the performance of a task) is not near in time to the theory, there is sometimes a loss in retention of the theory when the task is later attempted. This development would force the students to relearn the necessary information before they could accomplish the task. Sound learning theory suggests that the application for theory should be as close as possible in time to the theory in order to reinforce the learning.

It is also possible that in some cases, because of the scheduling structure, theory needed for an early task may not be taught until after the task has been accomplished (i.e., the manipulation involved hasn't been learned).

Under this traditional structure a student who is unable to stay with the group must either "drop-out" or spend many additional hours "keeping up" or "catching up". In either case, the situation is less than desirable.

For a student who does not enter with the group there are several possibilities. If students enter on a quarterly basis and there are several teachers available, each group would be conducted as above (provided adequate space and equipment are available). If students are accepted on a random basis, the instructor may try to catch them up to the group which most recently entered and then move the group along as before. In either case the typical structure does not lend itself to solving these problems.

With a curriculum based on an arbitrary time frame there is always the possibility of either having too little time and missing some important concepts or having too much time and holding a student who could already be gainfully employed.

In many instances the curriculum structure already discussed was based originally on a task analysis. However, the analysis lost some of its usefulness when it was dissected and recombined into large related blocks.

Without discussing the many reasons for moving to a new curriculum structure, the following discussion will point out the differences between the two designs and the evolutionary process from one to the other.

As mentioned before, the starting point for both curriculum designs is essentially the same. An occupation is broken down into major and minor blocks, where convenient. For each block the tasks are listed which are necessary for successful employment. Each task is broken down into what must be learned to successfully accomplish the task and the learning required is sequenced into the proper order. The tasks themselves are then sequenced where prerequisite listing is necessary. Where sequencing is not necessary the tasks are ordered in a logical manner.

The curriculum structure is now a listing of individual blocks of instructions which are very seldom rigidly sequenced. The block, when developed, will contain all the skills and knowledges needed to accomplish the task contained. These skills and knowledges will be learned as they are needed in conjunction with the task.

In the beginning phases of implementing a curriculum structured in this way, each student would begin with block Unit 101-1. The material for this unit would be individualized so that a student could enter at any time without upsetting any other student's learning or adding unnecessary hardship to the instructor. At this stage of implementation students would proceed through block 101 then move to block 102 and continue until they had completed all of the blocks necessary to lead them to their goal. Figure 4 depicts this sequence.

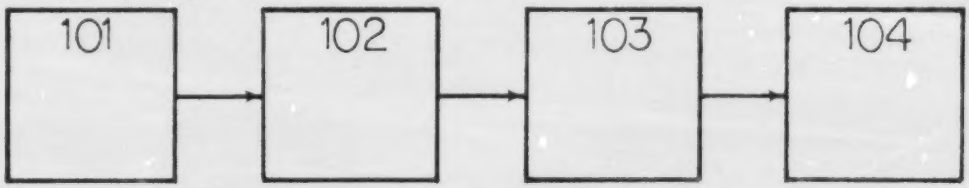


Figure 4

In this stage students continue to enter at block 101 and follow the same flow until they reach a decision point. Because the units in each option are individualized, the number available in the same program is controlled only by the number in the occupation and available equipment and materials.

At this point students continue to learn all the basic and advanced units before choosing an option. This does not leave out the possibility of students being given advanced standing or skipping units which they have previously mastered.

Figure 5 illustrates the addition of options to the basic program.

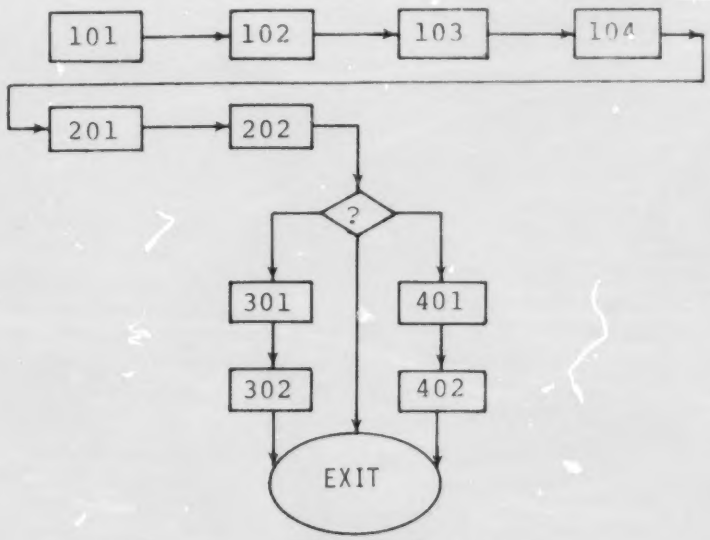


Figure 5

After the initial stages of implementation have been tested and modified as necessary, the curriculum structure can be used so that many different paths for student progress are available. The more self-contained the units are, the more flexibility there

is in moving through the tasks to desired objectives. In many cases all of the basic and advanced units are not required for each successive task. It may be for reasons of equipment use, student interest, available live work or student goals, that only a few basic tasks are needed before a learner moves to more advanced levels.

The instructor is now able to design a special program of study for each individual if the need arises. An entering student is able to specify needs when entering, and the instructor can prescribe only what is necessary to meet those needs. Applying this structure to the meeting of various goals will require that many different occupational specialties be analyzed so that only the tasks needed for that job are listed and sequenced. From time to time special additional tasks must be developed to fill voids in the original structure. These will allow for new options and allow by-passing of some task not needed for a special goal.

Figure 6 shows three different entry points, learning paths, and exit points within the same sequence of learning units. The size of the squares in the Figure illustrates the differences in time or amount of content between units. No attempt is made to keep these constant, but the content is dictated by needs of the task to be learned.

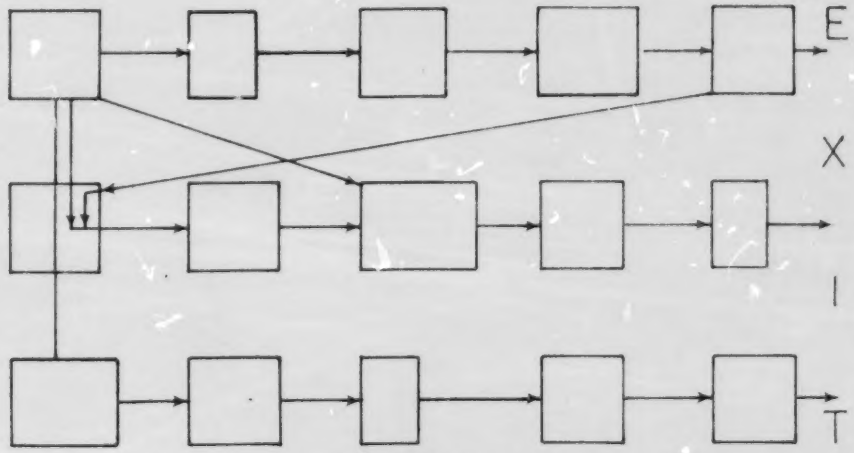


Figure 6

To reach the final stages in implementation of a truly flexible curriculum several steps are necessary.

1. The total curriculum for the single occupational program must be developed and implemented on an individualized basis. All learning must be planned and sequenced, all materials must be developed and tried, and each unit must be tested.

2. Different options must be analyzed and developed the same as the original program.

3. All units must be inventoried in such a way that the instructor can prescribe them on the basis of ultimate goal and prerequisite tasks.

4. A method of keeping track of daily equipment utilization must be developed so that prescribed tasks can be performed when needed.

5. Additional units and materials must be developed and tested as new needs arise (needs of both student and industry).

These requirements imply that the development must be continued indefinitely and the final structure will evolve as needs dictate its form. The ultimate system will be characterized by the following:

1. Students will enter whenever they have needs and space is available.

2. Students will exit whenever these needs have been met.

3. Students will progress through the curriculum by the path which most nearly fits their needs (as determined by the instructor).

4. At any one time it will be possible that no two students are working on the same task or equipment.

5. The facilities will be available for use during a major portion of the day.

6. Meeting new needs will not require a total curriculum overhaul, but only additions and slight modifications.

When these characteristics are present, the needs of individuals and industry will be met on a continuing, more realistic basis, and the facilities of the schools will be utilized on a more efficient basis.

6. TASK LISTINGS

11 Maintaining Working Station and Storage Area

12 Storing Drawings and Prints

13 Running Prints

14 Tracing Drawings in Pencil

15 Inking Drawings

16 Preparing a Drawing of a Graph

17 Preparing a Drawing of a Graph

18 Lettering Drawings with Guides and Ohter Media

21 Preparing a Single View Detail Drawing

22 Sketching Views

23 Preparing a Multiview Detail Drawing

31 Multiview Drawing with Full Section Views

32 Preparing a Multiview Detail Drawing With Half Section or a Broken Out Section

33 Preparing a Multiview Detail Drawing With a Revolved or Removed Section View

34 Preparing a Multiview Detail Drawing With OIffset or Aligned Section Views

41 Preparing an Isometric Drawing

42 Preparing a Pictorial Freehand Sketch

43 Preparing a Basic Technical Illustration

51 Preparing a Simple Set of Working Drawings

201 Preparing a Freehand Sketch of a Multiview Detail Drawing With a Primary Auxiliary

202 Preparing a Multiview Detail Drawing with a Secondary Auxiliary View

1-M Drawing Threads and Thread Fasteners

2-M Drawing Keys, Pins, Rivets, and Springs

3-M Drawing Gears and Cams

4-M Drawing Welded Assemblies

5-M Preparing Development Drawings

1-A Reading a Set of Plans for a Residence

2-A Prepare a Drawing of a Residential Floor Plan

3-A Prepare a Drawing of a Residential Foundation

4-A Prepare a Drawing of a Typical Detail Sheet

5-A Prepare a Drawing of the Elevation Views of a Residential Dwelling

6-A Prepare a Drawing of a Residential Plot Plan

7-A Prepare a Drawing of a Residential Electrical Plan

8-A Prepare a Drawing of a Residential Plumbing Plan

9-A Prepare a Drawing of a Residential Climate Control Plan

10-A Prepare a Complete Set of Working Drawings for a Single Family Dwelling

1-C Plotting Traverses and Bearing Calculations

2-C Drawing Plats

3-C Reading/Interpreting Vertical Measurement

4-C Computing Area of the Traverse

5-C Computing Vertical Highway Curves

6-C Computing Horizontal Highway Curves

7-C Plan and Profile Drawings

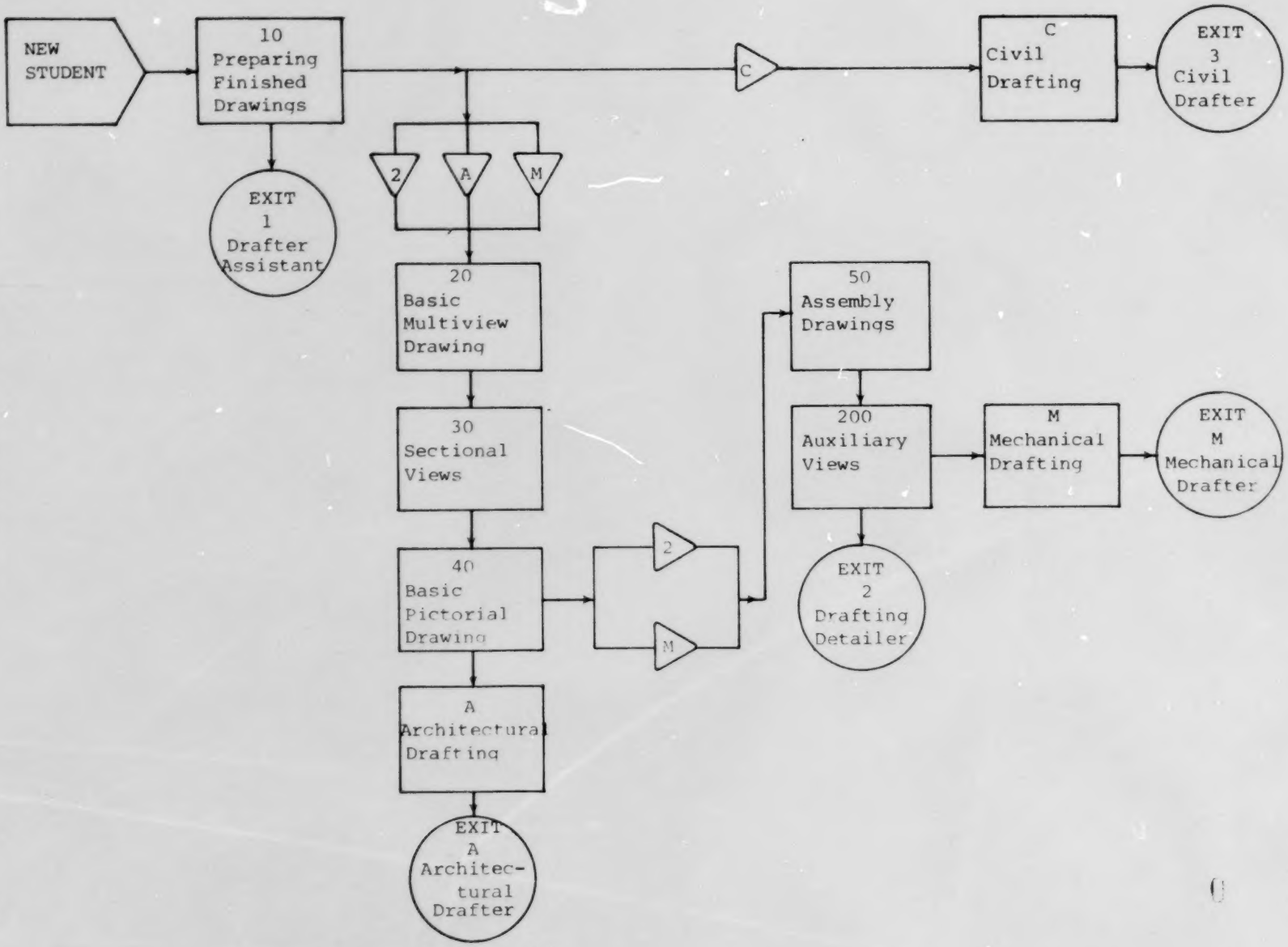
8-C Drawing Topographical Maps

9-C Preparing a Basic Structural Steel Framing Plan

7. BRANCHING OPTIONS

The curriculum has been structured so that all of the basic units contain examples from several options whenever it is possible and practical. The diagram on the following page illustrates how the major blocks of instruction are arranged and sequenced to provide a path for each exit point.

There are alternate paths and you will find that only selected tasks may be needed for specialized occupations. As you use and alter the curriculum to fit those jobs in your vicinity more possibilities will emerge.


NEW STUDENT
10 Preparing Finished Drawings
EXIT 1 Drafter Assistant
2
A
M
C
C Civil Drafting
EXIT 3 Civil Drafter
20 Basic Multiview Drawing
30 Sectional Views
40 Basic Pictorial Drawing
A Architectural Drafting
EXIT A Architec-tural Drafter
2
M
50 Assembly Drawings
200 Auxiliary Views
EXIT 2 Drafting Detailer
M Mechanical Drafting
EXIT M Mechanical Drafter

8. PROGRAM OPERATION GUIDELINES

A. ORGANIZING AND MANAGING AN LRC

The LRC or Learning Resource Center in an individualized instructional program takes the place of the classroom in the traditional group taught program. It is the center of all activities that are not manipulative and its proper set up and functioning is essential to any efficiently run program. Before beginning on this section, it would be helpful to read the selections listed below if they are available.

Installing and Operating An Individualized Instruction Program. Vocational Curriculum Center, Georgia State Department of Education. Pages 27 through 31, "LRC and Study Area Checklist."

Arrange for Improvement of Your Vocational Facilities, Module E-3. The Center for Vocational Education, Columbus, Ohio. Pages 6 through 13, "Improving Your Vocational Facilities."

Organize the Vocational Laboratory, Module E-8. The Center for Vocational Education, Columbus, Ohio. Pages 11 through 12, "Instructional Resource Center."

In these three selections you will find ideas and check lists for evaluating your present and future LRC. In the following discussion we will progress through the functions of an LRC and how these functions will be provided for. Finally, we will present a list of steps to take in designing and laying out your LRC and setting up a numbering and filing system.

Purpose of an LRC

The LRC (learning resource center) has been the object of much discussion and large amounts of money have been spent on building and equipping it. The questions should be raised and properly answered as to why such a facility exists. The objectives it fulfills or needs it satisfies are fundamental prerequisites to its existence. It is probably more easily described in terms of the needs it meets.

In group instruction where a classroom is available and students are working in step with one another, space is provided for reading, studying and all other activities except those to be done in a shop or laboratory. In an individualized instructional setting there must be an area for the same activities and additional areas not always needed in group instruction.

Generally these activities include:

Reading
Studying
Answering questions
Working problems
Looking and listening to audiovisuals
Using references
Doing research
Discussing ideas
Thinking over problems

The instructor also needs a place in which to discuss ideas, problems and solutions with one or more of the students. Because all of these activities are necessary, there must be an idea provided for them in the instructional facility. Because of the other functions associated with the LRC, an instructor's area can be fitted in so that he or she is still in continuous eye contact with the students.

Sometimes the title LRC conveys the impression that storage is a primary function of this area. Storage is provided only to accommodate the functions of the LRC. By studying the list of activities to take place you will be able to see that certain characteristics of the LRC design emerge. First, all of the activities to be performed need a quiet surrounding with a controlled climate. The area needs to be protected from dust, dirt and other shop and laboratory products. Next, the LRC needs to be well lighted for reading, writing, sketching and related work. The center needs to be close to the lab so that unnecessary time is not lost in transit to and from lab or shop. While it should be isolated acoustically from live work areas, it should be visually accessible from any position in the entire instructional area. While the instructor is in the LRC or shop he or she is still responsible for students in the other areas, and therefore, must be able to retain visual contact at all times.

It would seem then that, ideally, the LRC should be as close to the center of the lab as possible, cut off from the shop acoustically but not visually. Practically, a room or partitioned area as close to the center of the shop as possible is as good as we can expect. This is true as long as the partitions or walls are fitted from at least waist high to about 7 feet with glass or plastic.

By considering what the students will be doing in the room, you can begin to see how the room should be furnished and equipped. Since it would be impossible for the students to carry all of their learning materials with them from place to place, they should be available in the LRC and this dictates the storage functions of the center. Storage is needed for texts, references, manufacturers' manuals, audiovisuals, and other related items. In addition, both storage and space for the audiovisual equipment is needed.

The students will also be reading, writing and doing other activities which require desks or tables. Past experiences have shown that regular student desks are not as well suited to the needs of this center as round or rectangular tables and individual chairs. This type of arrangement provides flexibility for use with small or large groups as well as its primary functions for individualized instruction.

On page 26 of Installing and Operating An Individualized Instruction Program you will find two examples of functional LRC's.

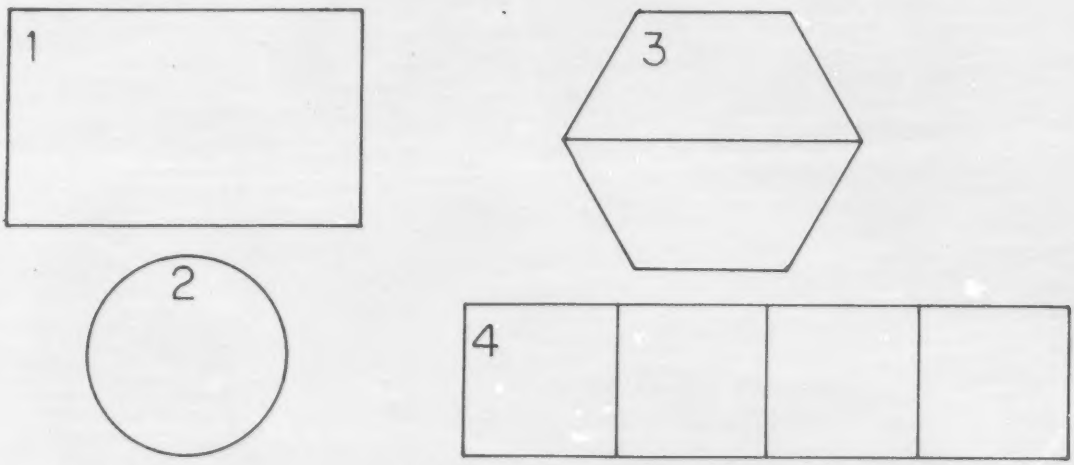
Contents of An LRC

In the previous discussion we mentioned what general types of space and functions are contained in the LRC. Now we need to look at these needs more specifically. First, we will look at the furnishings needed and then at the audiovisual equipment and accessories necessary to operate an individualized program on a minimum level.

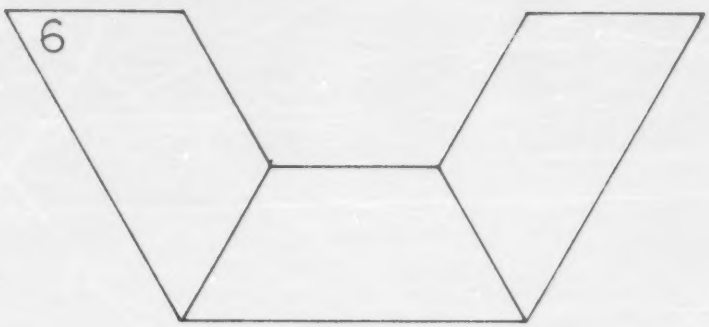
Study Area

Past experience has shown that only about one-third of the total student population needs access to writing or reading space at any one time. To be on the safe side you may want to provide writing spaces for one-third and then add a few spare chairs for reading only and small discussion groups. In terms of actual numbers, let's consider 24 students to be the maximum ever to be expected at any one time. This is too many for one instructor to handle on a regular basis, but this number might occur when some students are nearing the end of their programs and new students are being phased in. One third of 24 would be 8 writing stations. If we provide, in addition to that, 6 spare chairs we will have 14 seating positions which would accommodate one-half of the maximum load and two-thirds or more of the normal load.

There are many configurations and styles of tables available for these positions. The illustrations following show some of the possibilities.



Configurations 1 and 2 are standard tables placed away from walls so that there is access to all sides of the table. Arrangement 3 utilizes two of the now popular tables that can be arranged in many different designs. By placing these tables together as shown below they can be used on a wall in diagram 5 and as a small group discussion area with a moderator as shown in figure 6.



Arrangement 4 is for use on a wall where dividers are desired to provide more privacy. Using the type of spaces in figure 4 provides additional audiovisual carrels if needed. Where space is at a premium they can be used either as one or the other and counted as both, thereby reducing the total number needed.

Audiovisual Stations

In completely individualized programs that are heavily mediated only about one viewing station for every 8 students is needed. This applies only if one primary type of media, such as slide-tape sets, is used in the program. In that case, for our hypothetical class of 24 students, 3 viewing stations for slide-tapes will usually be enough. In addition to this, you will need to provide a station for every other type of playback equipment you will be using. The type and amounts of media you will be using will dictate your final needs.

Where heavy use of slide-tape sets depicting the steps of an operation are utilized, it is beneficial to have one portable carrel or viewing station so that the presentation can be viewed at or near the actual job.

Accessories for each of these stations should include at least two sets of cushioned headsets with individual volume control and a "Y" adaptor so that a playback of an audiovisual set can be viewed by more than one student at once. There should be one listening station in each LRC that will accommodate at least 8 headsets. Always keep at least two spare bulbs per projector.

Materials Storage

Many unique and novel devices are available for storing written and audiovisual materials. However, for ease of inventory, accessibility and low cost, open shelving is satisfactory for all items except cassette tapes. These should be stored in some sort of drawers or stacked units. In any case they should be so arranged and labeled that any missing items can be detected easily.

To estimate needed space you will need some idea of the number and size of written materials and audiovisuals. Then a simple total of linear feet will allow you to design a tentative storage unit.

One unit that should always be included in an LRC is a letter or legal size filing cabinet. Much of the information needed by the student is most easily stored in folders. The only efficient way of storing and retrieving folders is with a filing cabinet.

Planning the LRC

Before you determine the size of the LRC or the arrangement of its interior, you must have a list of the contents of the LRC. You will also need the dimensions of these items and their electrical requirements. After these items are known, you can plan and implement your ideas. We will first go through a step-by-step procedure for planning your LRC. As you follow these steps you should consult the checklist in Installing and Operating An Individualized Instruction Program. After you have completed the final plan, again consult this list as a check.

Remember, make plans for what you think will best fit your needs and then make adjustments to fit your resources. Never discard your "best' plan, but use it as a guide for future improvements.

Selecting Furnishings: Don't worry about arrangement at this time. Concentrate on furnishings and storage that will best fit your needs.

1. Estimate the number of each kind of station that you will need. Label these stations as to their use and then estimate the number needed.

Example 1

Studying and Writing	8
Reading/Small Group	6
Audiovisual Viewing	3

Example 2

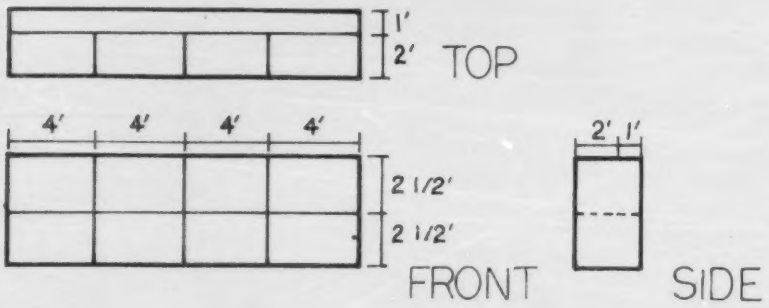
Studying/Audiovisual	8
Reading Only	4
Small Group	10

The number will depend on the maximum number of students in the program and the extent to which media, written assignments and studying will be done.

2. Sketch the furnishings you want to use. Be sure you have the dimensions of the top view of the furnishings as accurate as possible.

Example 3

Carrels for study/audiovisual viewing



You should sketch each type of furnishing to be included in your LRC. If electrical connections are needed, be sure to show this on the sketch.

3. Estimate the space you will need for storage of instructional materials. Below are some estimates you can use and some points to remember.

FOR DRAFTING PROGRAM:

Example 4

Slide boxes store in about 4 feet of shelf space.
Eight MM loops in boxes store in about 6 feet of shelf space.
Estimate books at about 8 feet of shelf space.
Current periodicals should be stored in a magazine rack type storage showing the front of the magazines.
Back issues of periodicals can be stored on shelves in boxes.
Cassette tapes are best stored in drawers where they can be quickly inventoried.
Don't forget at least one filing cabinet.

First, list the amounts of all the materials you will need and then estimate the space needed. By consulting office equipment and school equipment catalogs, you can get a good idea of sizes and available units. From these and from what you have seen in other programs, design units which will fit your needs. The rationale might be as follows:

Example 5

31 filmstrips
112 slide sets
31 8 mm loops
152 cassette tapes
200 reference manuals
150 pamphlets
6 current periodicals
12-3" boxes of magazines

Shelf Space:

112 slide sets ÷ 4/ft. = 30 feet*
195 reference manuals ÷ 8/ft. = about 40 feet*
(*at least 74 feet of shelving is needed)

Storage Cabinets:

In an equipment catalog you find a storage cabinet that will hold cassette tapes, 8 mm loops and filmstrips. You copy the specs and prices. The cabinets stack together and have the same top dimensions - 20 5/8" wide X 17 7/8" deep.

31 filmstrips - 1 drawer 4 5/8" high holds 100 filmstrips $46.00
31 8 mm loops - 1 drawer 7 3/16" high holds 60 8 mm cartridges $60.00
152 cassette tapes - 2 drawers 10 1/4" high holds 160 cassette tapes $104.50

You decide a 30" high table will be needed to hold the cabinet.

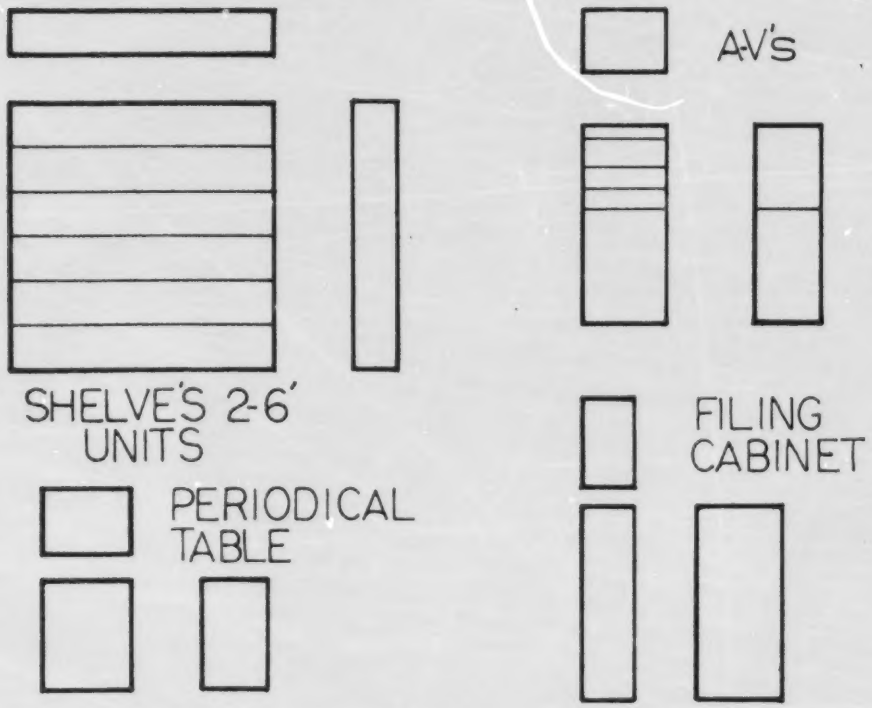
Filing Cabinet:

You decide on a four drawer letter size filing cabinet for the pamphlets. The dimensions of the cabinet are 25" deep x 15" wide x 52" high.

Other:

You decide to use a small table 18" x 24" for current periodicals and any new information that arrives. This will be a place for students to check on occasionally for new information in the field.

Next, you should sketch all of your storage units. Below are sketches for the items described on the previous page.

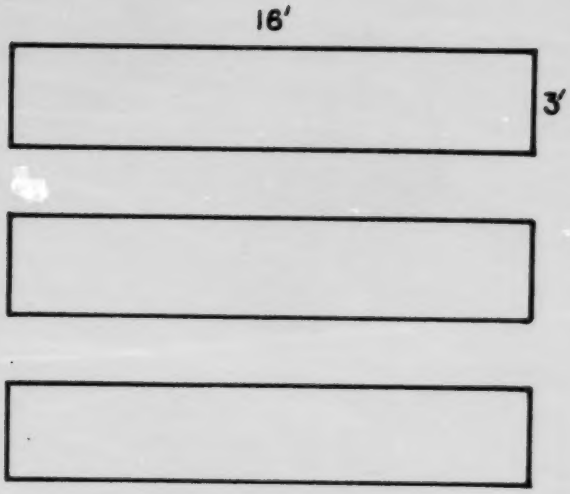


4. Now you are ready to lay out your LRC. The procedure we will use is one which architects, engineers, interior designers and others rely on. We will use a simple version of this procedure for the LRC.

You must first decide if you are going to use an existing space. That is, has your floor area already been determined for you? If you have some flexibility in the size of your LRC, it will be easier. In either case the same procedure can be followed.

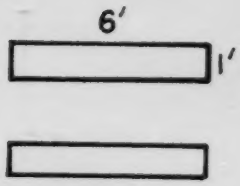
A. The method we will employ uses a grid sheet and scaled cut outs of all the furnishings to be placed in the LRC. The first step in the procedure is to list all of the items to be placed in the LRC. There is no need to draw them to scale at this time, but simply list them and make a top view dimensioned drawing.

CARRELS

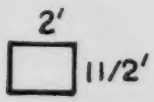


DISCUSSION TABLE

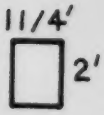
SHELVING



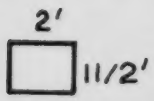
A-V DRAWERS



FILING CABINET



PERIODICAL TABLE



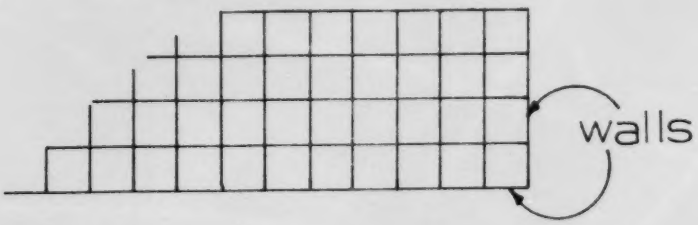
B. Next, draw each item to scale. Following are some hints that might help you.

Grid paper of 1/4" grids is available in most locations. With this in mind, a scale of 1/4" - 1' is a good choice. If you don't have a rule with a special 1/4" scale, it is easy to use any ruler for this increment. Make a solid black line around each silhouette you draw. It is best to use card stock for your cut outs, since they receive a lot of handling.

C. Now label each cut out and add any special information if there is room on the drawing. For example, you would want to remember that the carrels you are using have backs that could be placed either against a wall or against another carrel.

If you can't get the information on the cut out, make notation such as (1) and have a legend with notes.

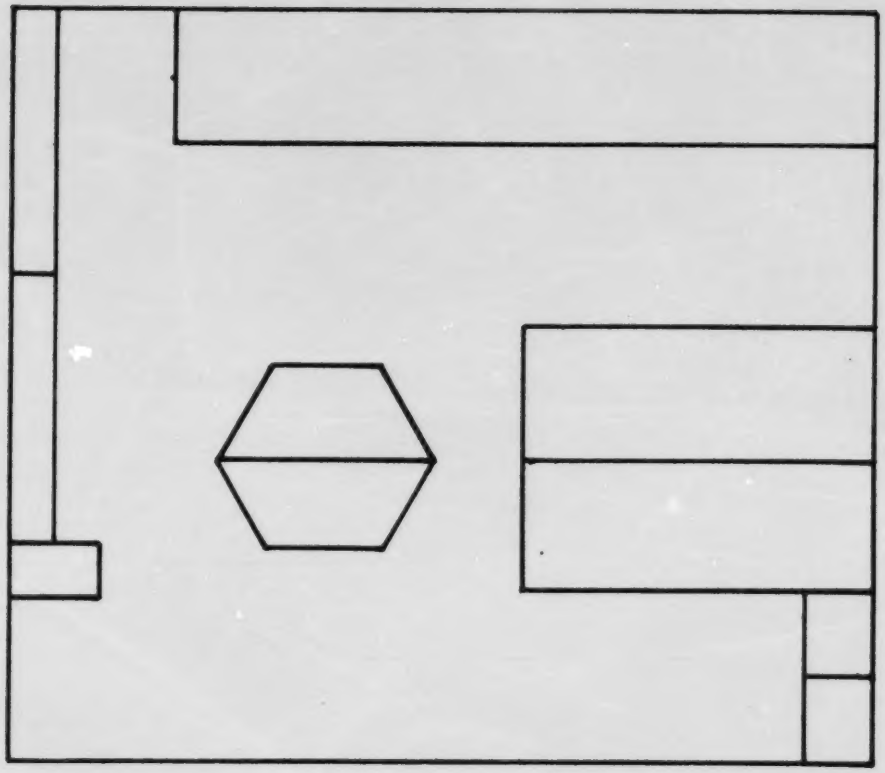
D. When you have finished all of your drawings and labeled them, you are ready to arrange them in your LRC. If you are planning for a new space, start by drawing a corner and work from there to determine how much area will be required for this new space.



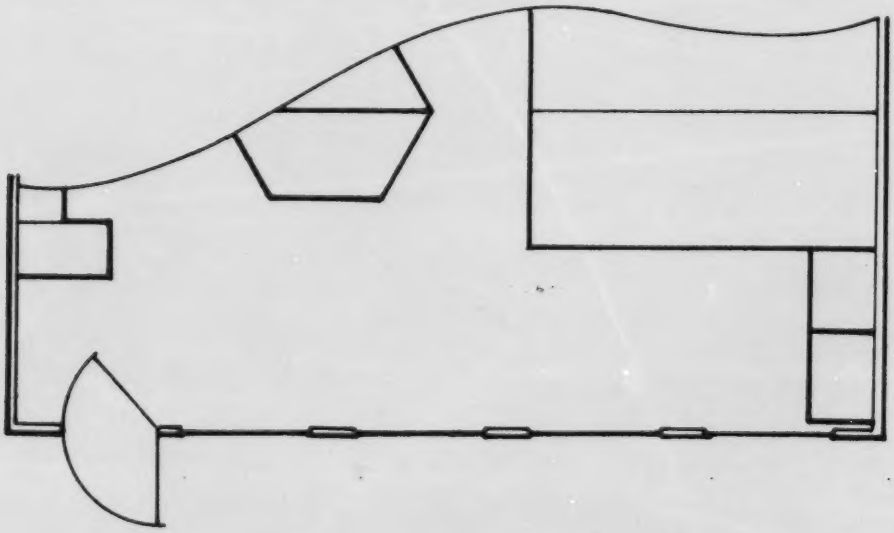
If you already know the area you must use at present, use it for now, but always keep a plan for the future. Draw the existing space on the grid sheet.

E. Now carefully cut out your outlines. You may also want to cut out some silhouettes for aisles or other areas to be kept uncluttered.

F. Now lay out your LRC. When you get an acceptable arrangement, sketch it on another grid sheet. Then, make another layout. Continue this process until you arrive at several arrangements with which you are satisfied.



G. Now draw in doors, windows, etc. This may eliminate some of your layouts.



Compare your layouts against the lists given in the references. Discuss them with other instructors and your supervisor. After you have settled on a plan, you should make a list of what you need to do to accomplish this plan. Each item listed should be detailed and the cost of carrying it out estimated.

When you have done this you are ready to present it to the administration.

Marking and Filing Instructional Materials

Every piece of instructional material you have for use by students should be properly labeled, catalogued and filed where it can be easily retrieved when needed. It is better to let the student do as much of the acquiring and filing of material as possible. This procedure is part of a learning process in itself. It will also relieve you of the repetitious work that takes you away from more important duties.

Those materials which come with the program must be labeled in the same way in which they are referred to on the unit sheets. This includes all texts, references, and audiovisuals needed for the program. For other materials which are for use in the program, but not specifically called for, the following method has proved successful and efficient.

Since the drafting curriculum uses a coding system which refers to task, you should consider using the same numbering as your filing system. As you know by now, the drafting program is divided into 9 major blocks. Each block is broken into tasks and these tasks are numbered.

In addition to selecting and using a numbering system for subjects, it is also important to identify each item uniquely. The permanent storage location of each item should also be labeled and recorded. In that way you can tell if an item is in the wrong location or if it is missing. As an example, we will illustrate the labeling and cataloging of a small manual.

B. REVIEWING PROGRAM MATERIALS

The following steps should be followed in receiving and reviewing materials. These instructions are taken from pages 13-17 of Installing and Operating an Individualized Program.

Receive audio visual materials

Along with the AV slides and tapes, you should receive what is known as a "Summary Sheet." This "Summary Sheet" will serve as a "check-in" list that you can use to verify that all non-commercial, state-developed audiovisuals have been received. The slides will be in boxes with each presentation separated by a colored slide mount. The first slide in each presentation has the presentation's I.D. number on it. Along with the slides, your AV shipment should include the cassette narration tapes and a copy of the script. If, per chance, any AV materials are missing, you should immediately send a post card to:

Vocational Curriculum Center
3952 Shirley Drive, S.W.
Atlanta, Georgia 30336
(404) 656-2614

Review and file AV's

First, put all the slides in proper position and sequence in slide trays. Next, view and listen to all the AV presentations while following the script. Verify that there are no mistakes, missing slides, etc. When you have completed putting the slides in trays and reviewing the AV, you should number the slides to aid you in replacing them in proper position should the slides be dropped or spilled. Another suggestion is to use a felt marker and draw a diagonal line across the top of the slides when they are in proper position. In this way, if slides are dropped, it is obvious in which position they belong. You should also make a duplicate copy of all cassette tapes and keep the originals in a safe place. Finally, place slides and tapes in their appropriate storage areas.

Review and file written I.I. materials

When the "software" (written material) arrives, you need to determine the filing method you will use, check the materials in against a "Summary Sheet" check-in list and then file all but two copies of the student and Instructor "software" (training materials). The student software, i.e. Unit Sheets, Information Sheets, Job Sheets, etc. may be filed in one of several ways.

* Total materials stapled as a book,
* stapled together by units with Unit Sheet on top and the other unit elements following as appropriate,
* or broken down into separate sheets with Unit Sheets in one file and Job Sheets in another file, etc.

Whatever method you use, be sure to file materials in an "easy-to-retrieve" manner. Use properly labeled folders and file the materials in proper sequence.

The instructor software should be organized for an easy-to-use system for you. Some instructors prefer the "two-notebook" per major-course-segment approach, while others prefer all "Instructor Answer Guide" information in one notebook. Those using the two-notebook approach generally organize their instructor information and answer masters into Theory and Practical instruction guides. The Theory notebook(s) contains all information and answer masters into Theory and Practical instruction guides. The Theory notebook(s) contains all information pertinent to oral tests, written tests and theory problems. The Practical notebook(s) contains appropriate information and answers for lab or shop work, practical performance tests and the like. In either case, the notebooks have dividers and tabs separating materials unit by unit for easy reference.

Preview all written materials received

Previewing accomplishes several important things.

*It familiarizes the instructor with the concepts, procedures, terminology and approaches used in the I.I. course materials.
*It affords the instructor the opportunity to compile the required list of needed text books, reference manuals and supplies required for the I.I. program.
*It allows a chance to evaluate if there is equipment that must be obtained in order to use the program as it is, or if slight modifications or adaptations need to be made in the materials in order to use them at your school. Caution! If any modifications are considered (by agreement of coordinator and instructor), then these modifications should be accomplished in close coordination with a curriculum and media specialist. Ideally, you will use the program as close to the original as possible! By all means, do not make changes without first trying the materials as they are.

C. STARTING STUDENTS

Many times you will be faced with starting both new and advanced students. If your timing is perfect, you may only have to deal with new students. In the case of new students, the best way to start them is in small groups several days apart. As an example, suppose you have fifteen new students who are to enter your program. Since all new students are to start with the same unit and require individual conferences, it is best to have them not only on different days, but at different times. You might divide the fifteen into three groups of five and assign them a day and hour to come. The schedule below illustrates how this might be accomplished.

Period	mon	tue	wed	thur
1	1*			6
2	2			7
3	3			8
4	4			9
5	5			10

*students

If you want more than one hour per student for orientation and conference, assign them so this time will be available. In this case you might establish a schedule as shown in the next illustration.

1	1	4	7	10
2				
3	2	5	8	11
4				
5	3	6	9	12
6				
7				

If all of the students must register on the same day because of school policy, let them register together and make time assignments as to when they should return. If you ask, some students may volunteer for delayed entry.

If you have some students who are returning after a period of layoff or a few advanced students use them as toolroom attendants until they receive orientation and are placed in the correct place in the program. They would have knowledge of the equipment and be able to assist you until the new students can take their turns.

After a few days, the students will spread out due to their varying abilities and learning speeds. Once the program is in operation you should never again have a large number of new students entering. This is due to the fact that they will be completing their occupational objectives at different times and new students will be taking their places immediately.

Since this program is individualized, students have the opportunity to progress on their own abilities. But before they can progress on their own, they must have knowledge of several areas. They must be aware of school policies and procedures, of the operating procedures of the program they are in, the location of what they will need and how the program operates. Many of these can be accomplished through individualized methods such as audiovisuals and written instructions. The materials that come with the program include an audiovisual presentation to explain the operation and use of the instructional materials.

Another item which must be discussed and decided upon is the program objective for the student. Next you must consider any prior training and where in the program is the best place for them to start. This program objective and plan for its accomplishment should be recorded and filed in the student's records. This and other items of an individual nature should be taken care of during a conference when the student arrives.

All of these procedures should be put into an orientation plan and prepared as an instructional unit.

D. HOW THE PROGRAM IS ORGANIZED

When correctly set-up, the drafting program should operate in the following manner.

After students enter and are given the proper orientation, they decide on the program objective which best suits their needs. Once this has been done, each student starts on the task assigned to him/her on the program.

The flow chart on the next page depicts the sequence of steps students might follow as they work through their tasks. Tasks may be primarily theory, primarily performance or a combination of both theory and performance. A majority of the unit sheets guide the students through reading/study assignments, audiovisuals and lab activities. Ideally, a task would be learned by the student's first learning the theory of the operation, next learning the procedures to be used, then practicing with instructor supervision, as needed, and finally being tested on performance. Where needed, more practice may be prescribed on live projects assigned to combine and reinforce skills. Live projects are also used to simulate actual occupational tasks.

E. PROBLEMS AND SOLUTIONS

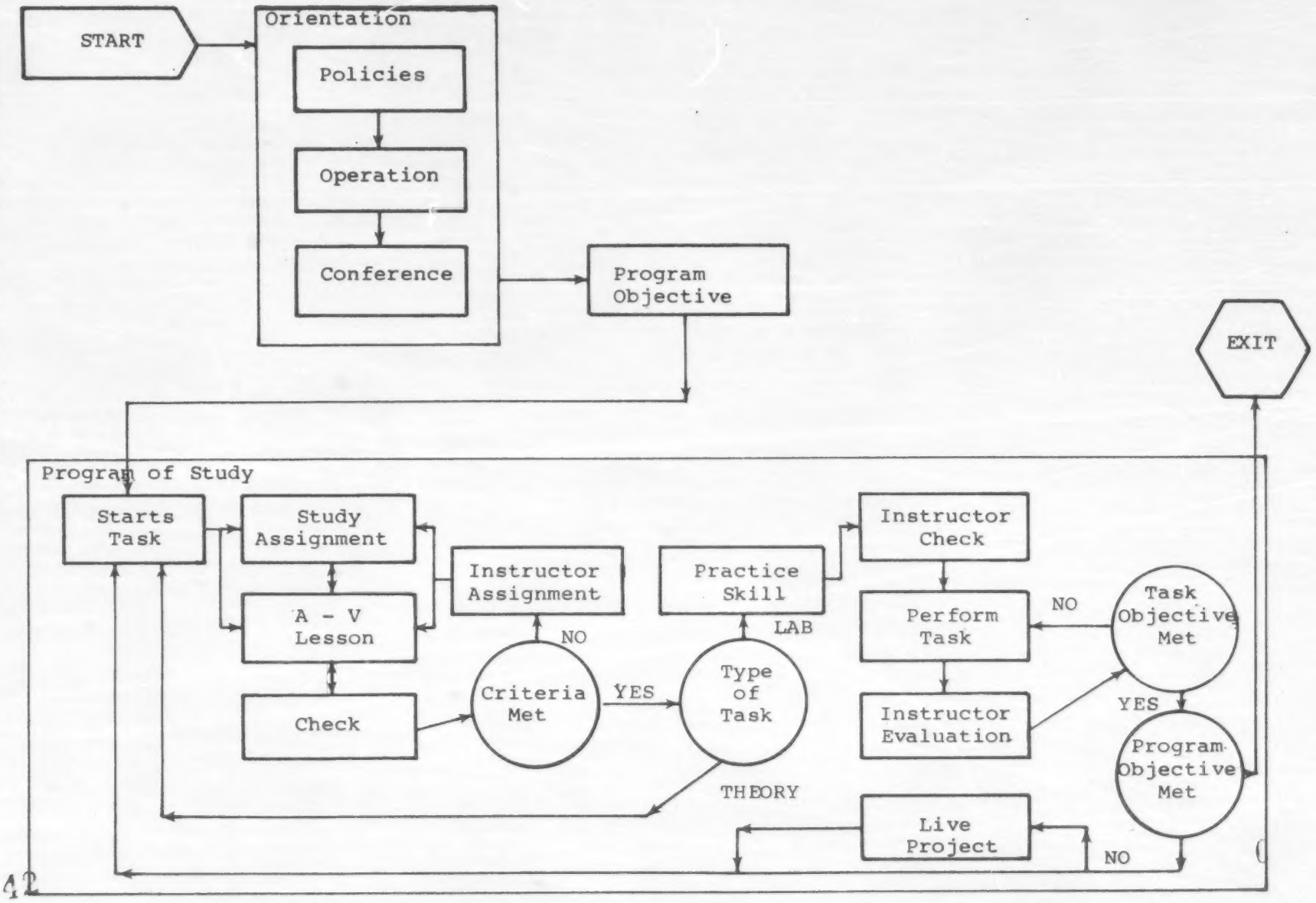
The student would continue to progress through the tasks on his/her program of work until the program objective had been completed. There are, of course, many problems encountered which hinder the program from operating properly. The most common problems encountered and some suggested solutions for these problems are found in:

Installing and Operating An Individualized Instruction Program, pages 43-59.

F. MANAGEMENT OF LIVE WORK

Live projects are essential to a complete drafting program; however, too much live work can also prevent a training program from operating. Some basic guidelines for live work should be established and these should be approved by your administration and then well publicized. Some of the most important points to remember are discussed below.

1. Live work should only be used to reinforce or add to a student's skills. This work does not constitute the training program, but is only another experience used to accomplish the objectives of the program.


START
Orientation
Policies
Operation
Conference
Program Objective
EXIT
Program of Study
Starts Task
Study Assignment
A - V Lesson
Check
Instructor Assignment
NO
Criteria Met
YES
Type of Task
THEORY
LAB
Practice Skill
Instructor Check
Perform Task
NO
Instructor Evaluation
Task Objective Met
YES
Program Objective Met
Live Project
NO

2. A student should not be forced to do projects which are not necessary to learning. Drawing one or two sets of house plans might be justifiable as needed for training. More than that number done by any one student would be excessive in most cases. Excessive repetition interferes with the progress of the student through the program of study.

3. A set of procedures and a work order form should be established. The work order form should contain statements that explain how the projects are to be done by the students and a release of the school and teacher from any liability should be signed before work is begun.

You should make sure that live projects enhance your training program and never hinder training that should be taking place.

4. Each project should be evaluated by the instructor and a record of the project and performance placed in the student's record.

G. STUDENT EVALUATION

Since there are well established criteria for the acceptability of drawings, it will be no problem to establish minimum standards of performance. A problem does arise when you begin to differentiate between levels of performance. To complete a task each student must meet the minimum standards. If you assign a value of "C" or 70 or some other arbitrary mark to minimum, then you must decide on what will constitute "B" or "A" or anything in between. In Installing and Operating An Individualized Instruction Program some suggestions concerning grading are given on pages 47 through 55. In the list below, some factors are given to consider when making your grading criteria.

1. The time required to reach the objective, that is how long it takes to learn how to do a task, may be a consideration in grading. Every effort should be made to encourage students to progress as fast as they can. By having the time as a grading factor, you may motivate the students.

2. The number of attempts at satisfying an objective would also contribute to a student's performance rating. You may want to grade a student higher if there is success on the first attempt rather than on subsequent tries.

3. Dependability is another trait which should be considered when evaluating student performance. Dependability includes attendance, punctuality, self-motivation and use of time. In view of recent research into the reasons workers are able to keep jobs, it has become apparent that skills are not as important in keeping jobs as are dependability and other personal habits.

4. Working habits and the quality of work done are important factors which need to be included in any evaluation. Good work habits are exhibited by a systematic and orderly approach to performing an assigned task. Good housekeeping is an example of good work habits.

Work quality includes conforming to standards which are expected by industry. Minimum standards are required, but above minimum standards deserve extra consideration.

On page 52 of Installing and Operating an Individualized Instruction Program an example of how certain factors used in evaluating students in an electronic program can be converted into a point system. You should consider this for your program in order to help you arrive at a performance grade.

H. STUDENT RECORDS

There are many records that an instructor is required to keep for administrative purposes. In this section we will discuss those records which pertain to students. These records are ones which are necessary if an efficient educational program is to be run. Before discussing what should be kept, it may be helpful to establish justification for keeping student records at all.

Certainly you must keep two kinds of information on students: grades and attendance. These are required in all educational situations and will probably always be required. Many teachers have been able to use one small record book and keep up with both of these items. With the increased use of individualized instruction and continuous change in student population, a need for individual records has become increasingly apparent.

Another reason for keeping more accurate records is found in the increased pressure from the public section to justify grades with documentation of performance. For these reasons a system is needed which provides for individual records of a more detailed nature than the traditional "class record book." Each student needs to be supplied with an individual file. As students leave and enter the program, these files can be moved from current to pending status and back again if a student re-enters.

What are the minimum records that need to be kept?

PERSONAL DATA
ATTENDANCE
GRADES
PROGRESS
TESTS
DISCIPLINARY
FOLLOW-UP

Whether an institution keeps a master record file or not, each instructor should maintain his or her own record system containing the above information.

Since most all institutions have a set procedure to keep attendance and personal data, we will leave these items to you.

Progress and grades are two items of extreme importance and can be easily kept together. At this point we will not discuss how you assign grades nor what methods you may use in evaluating student progress. We are concerned at this time only with the recording of these items. Since you are using an individualized instructional program developed by the State of Georgia, there is a progress chart with the program. This may fit your needs or you may decide that you need another form with more or different information.

The following information should be kept on any complete individual progress chart.

1. Student name
2. Student I.D. number
3. Unit titles and numbers for task to be worked on
4. Beginning date for unit
5. Ending date for unit
6. Written grade
7. Performance grade
8. Daily/Attitude/Work habit grade
9. Time spent on task
10. Unit grade
11. Course or major block grade

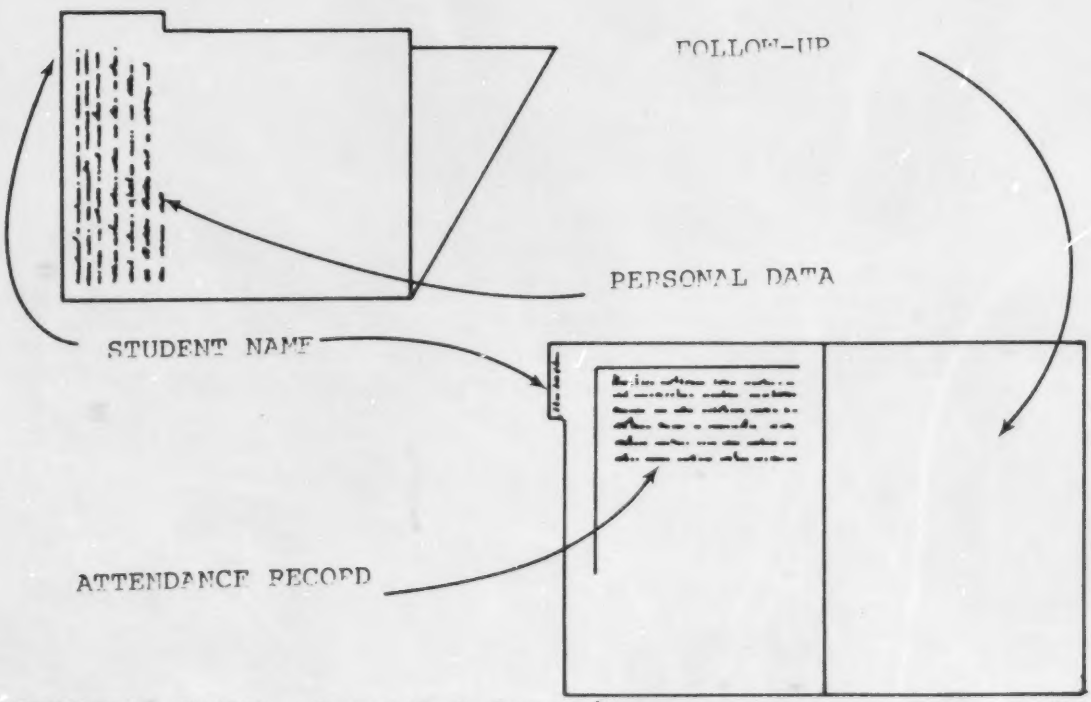
A portion of a progress report containing these items is shown on the following page:

NAME _____

NUMBER _____

UNIT NO.	START	END	TIME	GRADES				COMMENT
				WR	LAB	DAILY	FINAL	
OXYACETYLENE								
A-1								
A-2								
A-3								
A-4								
A-5								

Each student should have an individual folder in which the progress charts are contained. The documentation for grades in the form of tests and evaluation should be filed in the correct sequence behind this report. Since personal data and attendance records will be the same for every program, it is convenient to have this information printed on the folders.



Follow up data is also kept in the folder. Since this information is similar for all programs, it could also be printed either on the inside or back of the folder. The following information should be included. (New federal laws are beginning to require follow-up data when federal funds are involved in the training program).

1. Student's immediate employment after leaving the program.

2. Six month follow-up:

   A. Student success
   B. Employer satisfaction
   C. Assessment of value of program
   D. Additional tasks needed for job
   E. Included tasks not needed on job

3. One year follow-up

Your institution or new regulations may require more information or a longer period of follow-up. You must take this into account when designing your follow-up system.

We have discussed briefly a few of the important items that belong in your student record files.

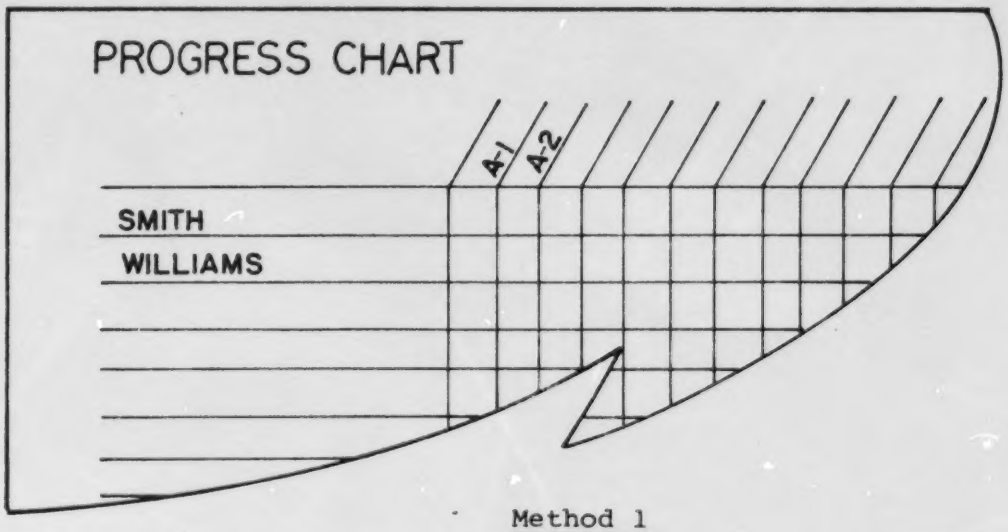
Designing your record keeping forms may be the easiest part of keeping records. The hardest part is collecting information, allotting time to complete the forms and filling in the data. The best time to record the information is when you get it. Since it is not convenient to carry all of your student folders with you (although some instructors use a portable filing cabinet to do this), you may carry a small notebook or stack of cards with you to collect the information. Later you can transfer this to your permanent files. Whatever you do, record your findings each day. Many instructors set aside a particular time each day for these activities.

I. GROUP PROGRESS CHARTS

Although you need an individual folder for each student, there are good reasons for having a group progress chart. One of the advantages to you is that it provides you with a quick determination of where all of your students are in the program and how rapidly each is advancing. If you fill in the chart correctly, you can use the information on it for managing student flow and lab utilization. You can also use it to determine which student is ready for live work coming into the lab and for estimating when you may have an opening for new students.

On the following pages are examples of ways to mark group charts and how the charts might look when filled in. One method of marking we will not be able to show here is the use of color. Many additional coding schemes are possible using color if you will put some thought to it.

Almost all wall progress charts are composed of blocks with spaces for task names across the top and student names going down the side. In lieu of printing actual task name many times, they are coded using a preassigned number.

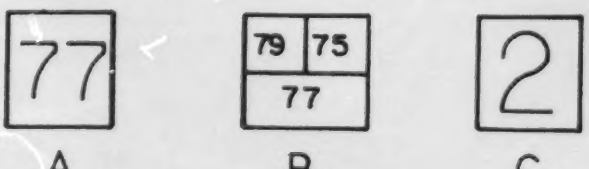


Method 1

The simplest method to use is merely to check the student off when he completes a job. The only information to be gained by this method is where the student is at any time. For some instructors this is all they want the group chart for. To these instructors it is important that the student not be compared to the group in any way. They think that grades or other information such as time spent on a job should be strictly confidential.

Method 2

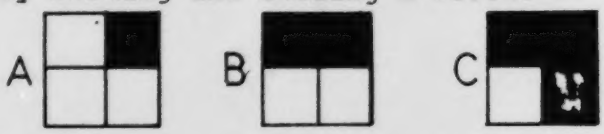
A similar method to number 1, but using different information, is to place grades in a square when the unit is completed.



In the same way that many instructors do not want grades displayed, others feel that this promotes competition among students. In example "A" only the final grade is shown. In "B" a lab grade "87", written grade "94" and final grade "91" are all shown. In example "C" a code has been used to signify the level of proficiency acquired by the student.

Method 3

Some tasks require that a student do them a certain number of times or for a certain period of time. In this case, progress may be kept by marking and shading a block.



In the progression shown above, an operation that requires four repetitions is shaded in the manner shown. The student's progress is from left to right with one fourth of the area being shaded on each performance.

This method provides the instructor with a quick reference from which to assign live work as it comes in.

Method 4

Many tasks in vocational education are divided into different proficiency levels. All of this information--the beginning and end and the learning phases of a task--can be coded in the same area on a progress chart. First look at the information to be shown:

1. Date learning of skill began
2. Date basic skill was learned
3. Performed successfully on practice drawing
4. Performed successfully on test drawing

The following sequence shows how this might be accomplished:

Task started on 3/1

Learning phase completed 3/17

Work on first plate completed

From 1 to 4 drawings completed

If only one is required, you may blacken the whole box. If more than one is required, you may show them by marking in only part of the box at the end of each job.

There are many other system which can be used. You should select the one which best fits your needs.

The following standard drawing checklist is appropriate for use with all drawings. Additional criteria may be needed for specific types of drawings such as sections or auxiliary views. Using the standard drawing checklist as a guide you will be able to develop other appropriate checklists for specific types when needed. Some of the items on the checklist may be only satisfactory or unsatisfactory, that is, there is no in between: for example; "3.1 - used correct sheet size." Others may be graded on a scale: for example; "1.4 all lettering is sharp and dark." If all lettering is sharp and dark the drawing would be completely satisfactory, but if a few letters are not satisfactory, you may want to count off the total grade.

The standard drawing checklist has a three point scale incorporated in it. The scale will allow you to use only the S-U boxes or to rate the item somewhere in between. The in between might be a record of the number of mistakes in that item, a letter grade or number representing a grade. Since some instructors may want to weight one of the 5 areas more heavily than the others, a space is provided for the total of each of the five areas. If you want one area, for example accuracy, to count twice as much you can double the grade for this item before it is added to the others.

There is also a space provided for you to enter the minimum mastery level score for each drawing. On the first drawing in a unit this should be lower than for the final drawing or performance test. The student should know the mastery level required for each drawing and have a copy of the standard drafting checklist if it is to be used.

You may feel that this it too time consuming for each drawing; however, it is a must for performance tests. Although criteria are listed beside each item, it is important that a standard be available for the student to use as a reference. The ANSI standards are most appropriate for this and each lab should have at least one copy of the Y14 series publications.

STANDARD DRAWING CHECKLIST

STUDENT _____ IMC NO. _____ DATE _____

NOTE* Denotes critical item. These items must be correct before drawing will be accepted.

Minimum mastery level _____ TOTAL SCORE _____

AREA	SCORE		WEIGHT		AREA SCORE		POSSIBLE
1	_____	X	_____	=	_____	/	_____
2	_____	X	_____	=	_____	/	_____
3	_____	X	_____	=	_____	/	_____
4	_____	X	_____	=	_____	/	_____
5	_____	X	_____	=	_____	/	_____

OBSERVED ITEM	S	-	U	CRITERIA
1. LETTERING				
1.1 Used guidelines for lettering.				Light (so that they need not be erased), horizontal and vertical (inclined) guidelines used for all lettering.
1.2 Selected proper letter style.				Upper-case (lower-case), vertical (inclined), single-stroke Gothic style.
*1.3 Used proper uniformity in lettering.				All lettering is uniform in style, height, slant (vertical/inclined), thickness of stroke, spacing between letters, and spacing between words.
1.4 All lettering is sharp and dark.				Clean-cut, crisp (free of smudges), and dense black. Enhances overall appearance of the drawing.
2. EXPRESSION				
1.2 All lines drawn sharp, dark and uniform throughout the drawing.				No double, uneven, and/or smudgy lines. All junctions and tangents are complete, clear, and distinct.
2.2 Used proper line definition.				Proper use of alphabet of lines. Distinct contrast between line widths (object, hidden, center, etc.). Each type line is properly constructed.
2.3 Used correct precedence of lines where necessary.				Visible lines given precedence over hidden and center lines. Hidden lines given precedence over center lines.
2.4 Construction lines drawn properly.				So thin that they can barely be seen at arms length and need not be erased.
2.5 Dimension and extension lines correctly.				Each line is thin, sharp, and dense black. Starting and termination points are clear and distinct. Proper space allowance between lines.
2.6 All arrowheads are drawn correctly.				Clean-cut, crisp and dense black. Uniform in style and size. Used proper ratio (3:1).
2.7 Used appropriate symbols where needed.				Used correct symbol for each type of material. Used the proper symbols to represent various features on the drawing.
3. LAYOUT				
3.1 Used correct sheet size.				Used sheet size specified. Selected proper sheet size when not specified.
3.2 Provided all the required information in the title block.				Information is complete, accurate, and clear. Must be lettered in a neat and legible manner.

OBSERVED ITEM	S	-	U	CRITERIA
*3.3 Selected and/or used appropriate views.				Used a combination of views that best described the object. Used only those views necessary to describe the object completely.
*3.4 Used proper view projection.				Used third-angle projection (unless otherwise specified). Each view is placed in its proper location. Appropriate space is provided between views. All surfaces are projected correctly.
*3.5 All views completed when necessary.				No missing, misplaced, or incorrect lines.
*3.6 All circles, arcs, and irregular curves and properly constructed.				Each is properly projected. All tangents and intersections of arcs with straight lines and/or other arcs are clean and smooth (without interruption in line flow). All irregular curves are smooth and uninterrupted.
4. ACCURACY				
4.1 Used correct scale.				Used specified scale or selected appropriate scale or scales when necessary.
4.2 All measurements are correct.				Measurements on the drawing represents the true full size dimension given for the object.
*4.3 All dimensions are accurate.				Each dimension on the drawing represents the true full size dimensions given for the object.
*4.4 All dimensions are complete.				No required dimensions and/or parts of dimensions are omitted. Each dimension figure is complete.
4.5 Dimensions are not duplicated.				Each dimension is shown only once.
4.6 Each dimension is properly located.				Shown in the appropriate view. Properly positioned in dimension line.
4.7 Required overall dimensions are [illegible]				Overall length, width, and depth dimensions are given.
4.8 Used proper alignment technique for stacked dimensions.				Dimensions are staggered for clarity when stacked one above the other.
4.9 All circles and arcs are properly dimensioned.				Used leaders and notes where required. Added R to indicate radius and D (Dia) to indicate diameter.
4.1 All angles are dimensioned properly.				Properly positioned dimension figures. Used leaders where appropriate. Symbols were used to denote degrees, minutes, and seconds.
4.11 Used general note or notes when required.				Used notes to eliminate excessive dimensioning or give other related information about the object or parts of the object. All notes properly located.
4.12 All leaders properly constructed.				Starting points correctly positioned and proper angle is used. Termination point properly positioned on the note and/or dimension figure.
5. CLEANNESS				
5.1 Drawing is clean.				Free of all unnecessary pencil marks, smudges, prints, eraser marks, dirt, food stains, drink stains, etc.
5.2 Drawing is undamaged.				Free of wrinkles, creases, tears, holes, etc.

9. LIST OF INSTRUCTIONAL EQUIPMENT

Because of the way a drafting laboratory must be set-up, one station per student, an LRC with writing stations is not necessary. It is useful because in many cases a student may not want to remove a drawing from the board, but at the same time may need to have a work space for study or writing. In general, past experience has shown that the audiovisual stations and equipment is needed for about one in 8 students. For a class of 24 this would mean 3 working slide tape playback units will be needed. In addition a filmstrip projector with playback and a tape player are needed.

In modern drafting establishments, especially where civil drawings are done, a small computer is needed. In this curriculum, several basic programs are presented in the civil section.

Headphones are a necessity so that students will not disturb one another and a multiple jack unit may be needed.

In summary, the following instructional equipment is needed in addition to the normal equipment used in drafting. These figures are for a maximum of 24 students.

- 3-4 slide-tape playback units
- 1 filmstrip-tape playback units
- 1 tape playback unit
- 8 sets of headphones
- 1 multiple jack unit

Optional but becoming more important to train students in up-to-date procedures.

- 1 small computer

APPENDIX A. TEXT LISTING

TEXT TITLE	ABBREV.	NO.	AUTHOR	EDITION	PUBLISHER
Architecture	A	1	Kicklighter	3rd	Goodheart-Willcox
Architectural Graphic Standards	AGS	2	Ramsey & Sleeper	6th	John Wiley & Sons, Inc.
Technical Drawing	TD	3	Giesecke et al	7th (6th)	Macmillan
Machinery's Handbook	MH	4	Oberg, Jones and Horton	21st	Industrial Press, Inc.
Elementary Surveying	ES	5	Brinker & Wolf	6th	Harper & Row
Drafting for Trades & Industry	DTI	6	Nelson	1st	Delmar
Structural Steel Detailing	SSD	7	AISC	2nd	American Institute of Steel Construction, Inc
Manual of Steel Construction	MSC	8	AISC	8th	American Institute of Steel Construction, Inc.

APPENDIX B. LIST OF REFERENCES

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APPENDIX C. READING LEVEL AND COMPUTATIONAL SKILLS

Reading Level. The texts used in basic drafting are designed by the publishers for high school and post-secondary use. However, many of the references and advanced texts are written at a higher reading level. The student should be made to realize that future advancements in drafting will depend upon his/her ability to read and interpret new materials and manuals.

Computational Skills:

In basic drafting students will need to be proficient in the following mathematical skills.

Add, subtract, multiply and divide

1. whole numbers
2. fractions
3. decimal numbers

Convert fractions to decimals. Convert decimals to fractions. Use of ratio and proportion.

In advanced drafting certain other skills may be necessary.

.Solution of simple equations
Use of trigonometric functions and tables (used in Civil)

In addition certain applications and design problems assigned by instructors may require the use of

Geometry
Conversion of weights and measures
More advanced equations